Critical factors conditioning the management of appendicitis in children during COVID-19 Pandemic: experience from the outbreak area of Lombardy, Italy

Editor

Due to pressure on hospital resources, the COVID-19 pandemic had profound impact on pediatric surgery practice. Elective schedules have been suspended, and only surgical emergency kept on, as for acute appendicitis (AA)[1]. As one of the regional referral center, we made several modifications in the diagnostic work-up and treatment, according to safety protocol for patients and healthcare professionals.

We retrospectively reviewed cases of AA in children during the Italian pandemic outbreak (February–May 2020) and compared them to those of 2019. We gathered the following information: age; sex; timing of early symptoms onset, admission to emergency department (ER), and surgery; treatment; antibiotic protocol; operative time (OT); length of stay (LOS); complications at 30 days.

During the pandemic we observed 14 cases of AA, demographically comparable to those of the same period in 2019 (13 cases). The mean time to admission to ER from symptoms onset was approximately 2-fold longer than in 2019, although not significant. We also observed a significant difference in the time spent in ER - to be ascribed to the nasopharyngeal swab (mean response time, 263 minutes) – and in the time to surgery after admission to ER, as well as a trend to significantly longer time between onset of symptoms and treatment. For all 2020 cases antibiotic therapy was started in ER and prolonged for one week, while in the past a single-dose perioperative prophylaxis was adopted for uncomplicated appendicitis. Laparoscopy was the surgical approach for all children. Conversion to open surgery was required for two cases in 2019, resulting in slightly longer OT. In 2020, a case was treated conservatively due to appendicular abscess. LOS was similar in both groups. Histological examination showed a higher prevalence of gangrenous appendicitis during the pandemic (50% vs. 15·4%; between-group comparison, $P = 0{\cdot}050$; Z-score for one proportion, $P < 0{\cdot}001$). No complication occurred within 30 days after surgery in both groups and no COVID-19 infections were recorded in patients and healthcare professionals. Data from our series are summarized in *Table 1*.

During the pandemic we observed an increase in the average length of time elapsed between the onset of symptoms and surgery, which in normal condition is influenced by several factors as elective activity, availability of theater and staff. A doubling of time to presentation in ER was reasonably the consequence of fear of COVID-19, which leads people with early symptoms to avoid access to hospital[2]. Delayed access to ER could explain the higher prevalence of com-

Table 1 Comparison between AA in children managed in 2019 and during COVID-19 pandemic

	2019		2020		
SEX	**No. (%)**	**Mean (SD)**	**No. (%)**	**Mean (SD)**	***P* Value**
Male	8 (62)		8 (57)		1
Female	5 (38)		6 (43)		
AGE (years)	13	8·9 (2·2)	14	9·1 (2·6)	.88
TIMING (hours)					
Onset of symptoms to ER presentation		25 (14)		42 (41)	.32
ER presentation to surgery		16 (10)		27 (14)	.019
Onset of symptoms to surgery		41 (17)		69 (46)	.038
Time spent in ER		3 (2)		9 (5)	.001
CLASSIFICATION					
Complicated	2 (15)		7 (50)		.050
Uncomplicated	11 (75)		7 (50)		
TREATMENT					
Conservative	0		1 (7)		.52
Surgical (Laparoscopy)	13 (100)		13 (93)		
CONVERSION TO OPEN SURGERY	2 (15)		0		
OPERATIVE TIME (minutes)		93 (54)		88 (43)	.41
LENGHT OF HOSPITAL STAY (days)		4·8 (2·2)		4·8 (2·2)	.46
COMPLICATIONS	0		0		–

Between-group comparisons of continuous variables were performed using non-parametric test, while categorical variables were analyzed by the Fisher's exact test. All tests were one-tailed, with exception of those used to analyze age and sex.

plex appendicitis. Although not significant, an increase to about 50% should be taken into consideration. Adherence to a safety protocol during the pandemic significantly prolonged the time spent in ER, mainly due to waiting for the swab response.

Some authors suggest considering conservative care of AA according to hospital capacities[3], while others to avoid laparoscopy[4]. Since ours is a referral center for pediatric surgical emergencies, we have implemented a safety protocol enabling to maintain a regular and mini-invasive surgical activity, with no contagion in patients and personnel.

Delayed access to and longer stay in ER seem to be the most critical factors conditioning the management and the prognosis of AA. Adoption of safety protocols could enable to reassure patients, facilitate access to hospital and improve their care, maintaining mini-invasive surgery[5].

The small sample size and the short follow-up in this single-center experience are recognized as limitation. Therefore, large prospective studies including retrospective data comparisons are needed to support this hypothesis. An evaluation of the impact of conservative strategies is also warranted.

Alessandro Raffaele[1], Anna Cervone[2], Maria Ruffoli[1], Emanuele Cereda[3], Luigi Avolio[1], Gian Battista Parigi[1] and Giovanna Riccipetitoni[1]

[1]Pediatric Surgery Unit, Department of Maternal and Child health, [2]Pediatrics Unit, Department of Maternal and Child health, and [3]Clinical Nutrition and Dietetics Unit, Fondazione IRCCS Policlinico San Matteo, Viale Golgi 19, 27100 Pavia, Italy @doctorsmile84

DOI: 10.1002/bjs.12004

1 Søreide K, Hallet J, Matthews JB, Schnitzbauer AA, Line PD, Lai PBS *et al.* Immediate and long-term impact of the COVID -19 pandemic on delivery of surgical services. *Br J Surg* 2020; https://doi.org/10.1002/bjs.11670 [Epub ahead of print].

2 Lazzerini M, Barbi E, Apicella A, Marchetti F, Cardinale F, Trobia G. Delayed Access or provision of care in Italy resulting from fear of COVID-19. *Lancet Child Adolesc Health* 2020; **4**: e10–e11.

3 Polites SF, Azarow KS. Perspectives on pediatric appendicitis and appendectomy during the SARS-CoV-2 pandemic. *J Laparoendosc Adv Surg Tech A* 2020; **30**: 356–357.

4 Scott C, Lambert A. Managing appendicitis during the COVID -19 pandemic in the UK. *Br J Surg* 2020; **107**: e271–e271.

5 Khan J, van Boxel G, Mercer S. Is minimal access surgery possible and safe during the COVID-19 pandemic? *Br J Surg* 2020; **107**: e268–e268.